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ABSTRACT

A novel approach to the collection and utilization of program treatment information that quantifies innovative educational practices is described. Data was collected from groups of students within grade and within subject matter area who were exposed to the same program characteristics. These flexibly defined "educational experience groups" were then clustered according to the particular approach to individualization implemented in each group. Methodological issues, substantive results, and implications of this typology for the analysis of a longitudinal data base are discussed. The data base for this study included 27,000 students, 1,000 teachers, and 90 schools. (Author/EA)

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APPROACHES TO INDIVIDUALIZATION:

TOWARD A TYPOLOGY OF INNOVATIVE EDUCATIONAL PRACTICES*

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Approaches to Individualization:

Toward a Typology of Innovative Educational Practices

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Introduction

During the 1970-71 school year, the American Institutes for Research (AIR) began full implementation of a U. S. Office of Education (USOE) sponsored longitudinal study of intensive, innovative education practices. The purpose of this project was to examine over a three-year period the relative effectiveness of various educational experiences or treatments. It was anticipated that these data would provide a valuable source of information that could be used in designing new educational programs and research efforts in the years ahead. This paper will discuss the general design and research goals of this study, the Longitudinal Study of Educational Practices (Project LONGSTEP) and then review the methodology used (1) to gather the study's treatment data and (2) to create treatment types representing the approaches to individualized instruction present in participating schools.

Introduction to Project LONGSTEP

The objective of Project LONGSTEP was to determine as comprehensively as possible over a three-year period (1) the relationships between selected innovative education treatments and student achievement and attitudes, and (2) the components of these treatments which have had the greatest impact on student outcomes. To realize this goal, the general design of the study involved the collection of three major categories of data each school year: (1) educational treatment data, composed of variables which measure the educational environment of which the student is a member, including

(a) characteristics of the educational program(s) in which each student participates and (b) characteristics of each student's teacher(s); (2) student characteristics (e.g., sex, socioeconomic status) brought by the student into his educational environment; and (3) student outcomes, including both cognitive and attitudinal outcome variables. Student data were obtained from specially designed student questionnaires yielding background information and attitudinal outcome measures and from standardized achievement tests yielding cognitive outcome variables. Teacher data were obtained from a questionnaire completed by each teacher. Educational treatments were documented by AIR staff via information gathered from interviews with principals and teachers, from classroom observations and from existing documentation of the treatment. Lastly, information identifying each student's teachers (by subject) was obtained and used to relate specific treatment and teacher data to individual students.

Since schools participated in Project LONGSTEP on a purely voluntary basis, it was not feasible to randomly assign students or student groups to treatment conditions; nor was it possible for AIR to systematically vary the treatments present in any given school. Rather, variation among the primary independent variables of th study was achieved through the selection of existing school programs. Thus, the schools invited to participate voluntarily in the study were chosen because, as a group, they represented a range of innovative practices and because they also varied with respect to other educationally relevant characteristics (e.g., socioeconomic level). Approximately 30,000 students, 1,500 teachers and 80 schools in 13 school districts located throughout the United States eventually participated in Project LONGSTEP during its three years of data collection (1970-71, 1971-72 and 1972-73).

Treatment Data Collection Methodology

Educational programs are composed of numerous related and unrelated processes or treatment components. For this reason, it was necessary to develop a system by which complex educational experiences present in the diverse sample of participating schools could be described and quantified with respect to specific observable educational characteristics. An Educational Experience Analysis Guide (EdExAG) was developed for this purpose. This guide provided the conceptual scheme and the practical questions and alternative responses that AIR project personnel could use in documenting the specific experiences of the students participating in the study. This guide, consisting of more than 80 items, was designed so that for each item it was possible to code the basic components or elements underlying a treatment on a continuum from "traditional" to "innovative." Quantitative measures of educational "treatment" derived from this guide could then be associated with participating students, regardless of the schools which they attended.

The data collection unit for educational treatment data was a flexibly defined entity called an Educational Experience Analysis Guide group or EdExAG group. Different EdExAG groups were identified within a school when an AIR site visitor could differentiate among the treatments received by different groups of students at a school by means of items found on the EdExAG. Defined in this manner, EdExAG groups could include as few students as those within one teacher's class for one subject matter area or as many students as those in all grades within a school for all subject matter areas of instruction. EdExAG groups, then, were created in response to treatment variations that existed within a school and within a grade and may be more or less viewed as an efficient but group-level approximation to the

documentation of each individual student's educational treatment.

During the 1970-71 school year, this treatment documentation methodology led to the identification of 141 such EdExAG groups, while 167 and 228 groups were isolated during 1971-72 and 1972-73 respectively. These groups, then, represented all of the different kinds of educational treatments that were provided by the schools to which students participating in Project LONGSTEP were exposed during each year of the project.

Measures of Educational Experiences

Prior to initiating analyses utilizing the EdExAG data, senior project staff who were familiar with the sites participating in the study and with educational program organization in general critically inspected each EdExAG item. Those items or combinations of items (i.e., tentative multi-item scales) were identified that would quantify what were judged to be the basic educational characteristics underlying the educational practices and procedures included in the study. Item and scale analysis procedures were then undertaken so that the measurement properties of the EdExAG items and the tentative scales might be examined.

The first step in the item/scale analyses of the EdExAG was to rank order the alternatives for each of the items on an a priori scale from lesser to greater innovativeness. Senior-level project staff then examined the intercorrelations among the items to confirm that scale items were more highly related to other items in the same scale than to items measuring different constructs. Final scale content was determined by considering these empirical relationships and by reaffirming that the items were measuring what were judged to be the same educational construct on a priori grounds. Last, the internal consistency of each multi-item scale was computed to provide some estimate of the reliability of the measurement

provided by each scale. Cronbach's (1951) coefficient alpha (α) was used for this purpose. Coefficients for the multi-item scales ranged from .54 to .82.

The Concept of the Treatment Group

For purposes of collecting treatment information during site visits to participating schools, educational treatments could not be defined independently of the school at which the information was obtained. A site visitor, for example, could only document educational experiences of the students in the participating school he or she was visiting, thereby identifying what have been called EdExAG groups. The data gathered at this stage, then, differentiated among groups of participating students <u>within the same school</u> who were exposed to different educational practices. Defined in this limited manner, a treatment could include, at most, all the students in a single school, provided that all these students had similar educational experiences.

It was originally thought, however, that EdExAG groups defined by this approach would not represent educationally unique configurations of practices. Some of the small, nonsystematic differences describing the EdExAG groups in each school could be educationally trivial or represent inaccuracies in documentation. Similarly, groups characterized by supposedly identical educational practices may not represent exactly the same treatment due to the lack of discriminability of the items on the EdExAG.

Considerations such as these, coupled with a concern that the project's analyses should focus on a limited number of educationally meaningful and identifiable student groups, suggested that students should be combined into larger analytic units based upon the similarity of their educational

experiences. Such a group was called a treatment group or treatment unit. Examination of achievement and attitude differences among such groups would then provide insights concerning the efficacy of the combinations of practices they involved.

Cluster Analysis Methodology

Combining EdExAG groups into larger analytic units representing different "types" of educational approaches was accomplished by means of a cluster analysis procedure based upon Q-type factor analysis. Separate analyses were conducted for the data collected each year and for language arts (n = 92, 1971-72; n = 103, 1972-73) and mathematics (n = 89, 1971-72; n = 93, 1972-73) groups separately.

Since the objectives of these analyses were to create a limited number of distinct but educationally meaningful treatment "types," it was first necessary to define the variable space within which combinations of EdExAG groups were to be identified. Although it would have been possible to quantify differences/similarities among EdExAG groups with respect to all 25 EdExAG scales, it was decided that the clusters derived would be more interpretable and meaningful if the scales used represented measures of the same underlying educational construct. Furthermore, if these scales described what were considered to be major differences in educational approaches, the clusters identified would represent a parsimonious number of types of treatments which were maximally different with respect to these key treatment components. For this reason, the 10 EdExAG scales which indexed some of the major ways in which project schools were individualizing instruction were selected to be the profile elements describing the approach of each EdExAG group. The 10 scales were: Utilization of Objectives, Individualization in Decision Making, Teacher or Locally Developed Materials,

Individualization of Instructional Pace, Scheduling Characteristics, Use of Performance Agreements, Classroom Group Organization, Teaching Unit Composition, Completeness of Instructional Package, and Utilization of Student Evaluation. These scales were chosen (1) because they represented ways in which sample schools were achieving some degree of individualization; (2) because one of the criteria used in selecting schools for participation in the project was individualization; and (3) because these scales documented some of the major process dimensions that are of current interest in education.

Next, each of the EdExAG scale scores was transformed to a deviation score by subtracting the scale mean (computed across all EdExAG groups in the analysis). A Q-type average cross-products matrix was then computed to provide a multivariate measure of the similarity of each EdExAG group with every other group with respect to the 10 individualization scales. Both Nunnally (1967, pp. 372-388) and Overall and Klett (1972, pp. 180-239) have discussed such vector-product measures of similarity and have noted that they are particularly useful indices since they can be subjected to rather "powerful" methods of analysis such as factor analysis.

Each Q-type average cross-product matrix was subjected to a principal factors analysis in which each diagonal value was the average cross-product of an entity (i.e., EdExAG group) or profile with itself. Four factors were extracted in each analysis and rotated to a varimax criterion. This number of factors was specified since four factors accounted for 71% or more of the trace (sum of the diagonal elements) of each matrix, and since a relatively parsimonious solution was desired and since the number of categories created was expected to be two times the number of factors.

For purposes of defining cluster membership, these Q-type factors were viewed as "ideal types" of treatments. EdExAG groups were assigned

to one of eight clusters on the basis of the rotated factor on which each was loaded most highly (in terms of absolute value) and on the basis of the sign of that loading.

In order to interpret the educational characteristics of the groups that were formed, the EdExAG scale scores in the original data matrix were converted to standard scores and the mean and standard deviation of the EdExAG groups included in each cluster were computed. A profile for each cluster was plotted, each element being equal to the mean standard score for all EdExAG groups comprising the cluster.

Discussion of Cluster Results

Project LONGSTEP staff who were familiar with the schools and EdExAG groups present in the study inspected the mean profiles which had been plotted. The most obvious trend in all of these mean profiles was the fact that clusters defined as being positively and negatively related to the same "ideal treatment type" (i.e., bipolar Q-type factor) tended to have profiles which were mirror images of each other. Secondly, the highest loading for about one-half of the EdExAG groups was on the first Q-type factor and for this reason, the largest cluster groups were those defined by that factor. Third, the treatment approaches defined by the first factor were, for both school years, a generally "innovative" group and a fairly "traditional" group. Fourth, although there were some similarities of profiles across years, the combinations of approaches represented by the groups defined from the last three Q-type factors were very complex and, in general, did not exist for two consecutive school years. Last, examination of the profiles by staff familiar with each of the EdExAG groups from which the clusters were created confirmed that these groups more-or-less reflected the kinds of approaches actually present

in the schools. The most valuable result of these procedures, however, did not become apparent until the cluster codes were attached to individual students and until student membership in the various combinations of two-year "treatment" paths were examined.

As noted earlier, the Educational Experience Analysis Guide groups identified during each school year represented the population of different kinds of educational approaches to which participating students were exposed in a given school year. EdExAG groups were not defined on a longitudinal basis because the students in the same EdExAG group on 1971-72 (e.g., Mrs. Jones, 4th grade language arts class) were not necessarily in the same EdExAG group the next year. For this reason, each individual student's EdExAG group membership was attached to his record. Following the cluster analyses described above EdExAG group codes were used to create for each student a treatment group code for language arts for 1971-72 and for 1972-73. Cross-tabulations of these two codes were then run to show the numbers of students following each of the possible longitudinal treatment paths.

Examination of these tabulations showed that very few students followed a longitudinal combination of treatments that involved either "generally innovative" (≈ 13%) or "generally traditional" (≈ 8%). Since the nature of the other treatment types present during each year was complex (though meaningful) and since longitudinal movement of students across years was also very complicated, the analysis of the impact of such complex patterns of educational treatments over time would tend to produce results which would not be amenable to meaningful interpretation. For this reason, the typological approach to the analysis of the Project LONGSTEP data base was reconsidered. The paper will conclude with a review of the conclusions reached.

Although the concept of a typology based upon approaches to individualization is extremely appealing from both an educational and analytic point of view, the results described above more-or-less demonstrated some of the shortcomings of such a procedure. First, it is possible that the variables used to describe EdExAG group similarities (i.e., the EdExAG scales) were unstable indices of the constructs they purported to measure. This is unlikely, however, since the same project personnel visited the same schools in both years and since treatment documentation in 1972-73 was based upon noting changes from the previous years. It is more likely that the 1972-73 EdExAG data underestimated changes (and were more stable than they should have been).

Second, the treatment "types" identified tended to be very complex combinations of component practices and procedures, with the exception of the "generally innovative" and "generally traditional" groups developed from the first Q-type factor. There are at least two possible explanations for these results: (1) since the project schools were selected to represent a wide range of educational approaches, stable groups could not be identified because the sample was both small and very heterogeneous; and (2) the clustering method used was not appropriate to these kinds of data.

In order to determine if the clustering results were a function of the methodology utilized, the data matrices used in the 1971-72 and 1972-73 language arts analyses were converted to orthogonal principal component scores. Squared distances among EdExAG groups were computed and used to cluster the EdExAG groups by means of Ward's (1963) hierarchical grouping procedure (Veldman, 1967). Although the mean profiles for a number of clusters were similar (most notably, the "generally traditional" cluster),

there were still substantial differences between the groups created by the two techniques. The hierarchical groups, however, were equally complex and the longitudinal treatment paths of students based on the clusters were also complicated. These trends suggested that the cluster results obtained were somewhat method dependent.

This combination of findings also suggested additional explanations for our observations. It was quite likely (a) that the kinds of educational experiences available to sixth graders were different from those available to fifth graders and/or (b) that the practices and procedures themselves had changed. Of these two, changes in educational practices over time probably provides the most adequate explanation. At an experiential level, at least, numerous site visitors have noted substantial changes in program components over the course of this study--innovation, then, appears to be as much a process as it is a unique set of school practices. In spite of a number of methodological limitations, the cluster results reported in this paper more-or-less led to the same conclusion.

These results also imply that future attempts to develop typologies of innovative practices that are stable across school years and for different samples of schools may not meet with much success.

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